

(43)Date of publication of application : 29.11.1996

(51)Int.Cl. H01M 4/58 H01M 4/02 H01M 10/40

(22)Date of filing : 23.05.1995 (72)Inventor : TOKUO INAMASU
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[Claim 1] The secondary battery that use a positive active material expressed by $\text{Li}_a\text{Ni}_b\text{M}^1_c\text{M}^2_d\text{M}^3_e\text{O}_2$ (wherein, M^1 is at least one sort of elements chosen out of Co, Mn, and Fe, M^2 is at least one sorts of elements chosen out of B, Al, In, and Sn, and M^3 is at least one sort of elements chosen out of Mg, Zn.

- $\text{LiOH} \cdot \text{H}_2\text{O}$, Ni_2CO_3 , CoCO_3 , B_2O_3 , and MgO were used.
- The mole ratio, $\text{Li} : \text{Ni} : \text{Co} : \text{B} : \text{Mg}$ is $1.03 : 0.88 : 0.10 : 0.01 : 0.01$.
- The mixture was calcinated at 750 degrees C under oxygen atmosphere for 20 hours. After calcination, it was cooled in dry air, and was milled.
- Cathode : Acetylene black : PTFE = 85 : 10 : 5
- Positive electrode is dried at 200 degree C in vacuum.

Counter electrode is Li metal.

Electrolyte is EC/DEC (1:1 vol%)

A02

[0024] (Example 2 - coin cell A2)

LiOH·H₂O, Ni₂CO₃, CoCO₃, Al₂(NO₃)₃, and MgO were used.

- The mole ratio, Li : Ni : Co : Al : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0.01.

[0025] (Example 3 - coin cell A3)

LiOH·H₂O, Ni₂CO₃, CoCO₃, In(NO₃)₃·xH₂O and MgO were used.

- The mole ratio, Li : Ni : Co : In : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0.01.

[0026] (Example 4 - coin cell A4)

LiOH·H₂O, Ni₂CO₃, CoCO₃, SnO and MgO were used.

- The mole ratio, Li : Ni : Co : Sn : Mg is 1.03 : 0.88 : 0.10 : 0.01 : 0.01.

[0027] (Example 5 - coin cell A5)

LiOH·H₂O, Ni₂CO₃, CoCO₃, B₂O₃, and ZnO were used.

- The mole ratio, Li : Ni : Co : B : Zn is 1.03 : 0.88 : 0.10 : 0.01 : 0.01.

[0028] (Example 1 of a comparison – coin cell B1)

LiOH·H₂O, Ni₂CO₃ were used.

- The mole ratio, Li : Ni is 1.03 : 1.00.

[0029] (Example 2 of a comparison – coin cell B2)

LiOH·H₂O, Ni₂CO₃, CoCO₃ were used.

- The mole ratio, Li : Ni : Co is 1.03 : 0.90 : 0.10.

[0030] (Example 3 of a comparison – coin cell B3)

LiOH·H₂O, Ni₂CO₃, B₂O₃ were used.

- The mole ratio, Li : Ni : B is 1.03 : 0.90 : 0.10.

[0031] (Example 4 of a comparison – coin cell B4)

LiOH·H₂O, Ni₂CO₃, CoCO₃, B₂O₃ were used.

- The mole ratio, Li : Ni : Co : B is 1.03 : 0.89 : 0.10 : 0.01

[0034]

[Table 1]

電池	放電電流 3mA 放電容量(mAh)		放電電流 10mA 放電容量(mAh)	
	1サイクル	10サイクル	1サイクル	10サイクル
A1	65	64	58	55
A2	66	63	57	54
A3	65	64	57	55
A4	66	64	56	53
A5	66	63	55	52
B1	52	45	28	25
B2	50	43	29	24
B3	49	40	30	25
B4	63	62	30	28

Discharge current = 3mA

Discharge capacity (mAh)

1st cycle

10th cycle

Discharge current = 10mA

Discharge capacity (mAh)

1st cycle

10th cycle

[0035] As shown in Table 1, the cells A1, A2, A3, A4 and A5 by this invention had a large initial discharge capacity compared with the comparison cell B1, B2, and B3. Furthermore, the cells A1, A2, A3, A4 and A5 by this invention had a good rate capability compared with the cell B4.